

CLAIMS

I/WE CLAIM:

1. A method of thermoforming comprising the steps of:  
(a) positioning a heated sheet of thermoplastic material over a cavity having an upper lip and having an undercut portion beneath the lip;

5 (b) drawing the heated sheet of thermoplastic over the upper lip and down into the cavity and into the undercut portion;

10 (c) passing a cutting die into the upper lip to separate the thermoplastic material at the upper lip; and  
(d) separating the cavity at the undercut portion to extract formed thermoplastic material.

2. The thermoforming method of claim 1 wherein the cavity includes at least one ejector pin for pushing the formed thermoplastic material from the cavity when the cavity is separated.

3. A thermoformed shell having a base surrounded by integrally formed side walls extending upward to a cut lip, the walls and base formed of a single thermoplastic sheet and defining a volume, the cut lip extending inward about 5 the volume.

4. The shell of claim 3 wherein the upwardly extending walls include a ridge below the cut lip, the ridge protruding away from the volume.

5. The shell of claim 3 wherein the ridge is sized to support the shell on a lower surface of the ridge against a cut lip of a second identical shell with the bases of the two shells spaced apart when the shell is nested within the 5 second identical shell.

6. The shell of claim 5 wherein the ridge has at least one wall obtusely angled with respect to an adjoining portion of the side wall so that a gap is formed between ridges of the two shells when they are nested.

7. A closable thermoformed shell comprising:

(a) a first half having first side walls formed of a first single sheet of thermoplastic material, the first side walls extending upward to a first cut lip to define a first 5 volume, the first cut lip extending inward about the first volume; the first side walls including a first ridge below the first cut lip, the first ridge protruding away from the first volume; and

10 (b) a second half having second side walls formed of a second single sheet of thermoplastic material, the second side walls extending downward to a second cut lip to define a second volume, the second side walls including a second ridge above the cut lip, the ridge protruding away from the second volume and sized to receive and fit over the first 15 ridge to hold the first and second halves together.

8. The closable thermoformed shell of claim 7 wherein the second cut lip extends inward about the second volume.

9. The closable thermoformed shell of claim 7 wherein the second cut lip extends outward from the second volume.

10. The closable thermoformed shell of claim 7 wherein an adhesive material is placed along the second ridge at a point of contact with the first ridge.

11. The closable thermoformed shell of claim 7 wherein a flexible tab is attached to one of the first and second halves between the first and second ridge and extends outward therefrom to be grasped for separation of the first and second halves.

12. The closable thermoformed shell of claim 7 wherein the first half includes an aperture located near the first ridge to expose a portion of the second half beneath the aperture when the first and second halves are together, the aperture sized to permit pressure to be asserted against the second half to separate the first and second halves.

13. The closable thermoformed shell of claim 7 wherein the first half includes an aperture located near the first ridge, and including a cam having an operator protruding through the aperture and having a cam surface attached to the operator to rotate with rotation of the operator, the cam surface extending between the first and second ridges when the first and second halves are together, rotation of the cam surface pushing the first and second ridges apart.

14. The closable thermoformed shell of claim 7 wherein the first ridge has a terrace in the side wall beneath the ridge displacing the ridge by substantially a thickness of the second thermoplastic sheet toward the second volume, the 5 terrace being positioned near the second cut lip when the first and second halves are together, the terrace causing the second cut lip to lie substantially flush with the first side wall to resist separation of the first and second half catching of the second cut lip.

15. The closable thermoformed shell of claim 7 including a bag liner positioned within the first and second halves.

16. The closable thermoformed shell of claim 7 including a clamping portion having third side walls formed of a third single sheet of thermoplastic material, the third side walls extending to a third cut lip to define a third volume, the third cut lip extending inward about the third volume; the clamping portion sized to fit over a portion of the first and second halves when they are together to hold them in engagement.

17. A closable thermoformed shell comprising:

(a) a first half having first side walls formed of a first single sheet of thermoplastic material, the first side walls extending upward to a first cut lip to define a first volume, the first cut lip extending inward about the first volume; a portion of the first side walls including a first hemicylindrical hinge ridge below the first cut lip, the hinge ridge protruding away from the first volume; and

(b) a second half having second side walls formed of a second single sheet of thermoplastic material, the second side walls extending downward to a second cut lip to define a second volume, the second side walls including a second hemicylindrical hinge ridge above the cut lip, the second hinge ridge protruding away from the second volume and sized to receive and fit over the first hinge ridge to hold the first and second halves hingably together.

18. A thermoformed shell comprising:

(a) a thermoformed shell having a base surrounded by integrally formed side walls extending upward to a cut lip, the walls and base formed of a single thermoplastic sheet and defining a volume, the cut lip extending inward about the volume for a portion of the cut lip.

a card sized to be slidably received along the upper edge of the side walls beneath the inwardly extending cut lip.

19. A thermoformed shell of claim 18 wherein the card includes foldable side tabs which may fold flat against a main body of the card for sliding of the card in place along the upper edge of the side walls and that fold outward along the side walls when the card is in place on the shell to retain the card against removal.

20. The thermoformed shell of claim 3 wherein the upwardly extending walls includes a ridge below the die-cut lip, the ridge protruding away from the volume and extending substantially continuously around the upwardly extending walls.

21. The thermoformed shell of claim 3 wherein the die-cut lip extends substantially continuously around the upwardly extending walls inward about the volume.

22. The thermoforming method of claim 1 wherein the cavity is shaped so that the separated thermoplastic material is a shell having a base surrounded by integrally formed side walls extending upward to a cut lip, the walls and base formed of a single thermoplastic sheet and defining a volume, the cut lip extending inward about the volume.

23. The thermoforming method of claim 22 wherein the cavity is shaped so that the upwardly extending walls include a ridge below the cut lip, the ridge protruding away from the volume.

24. The thermoforming method of claim 23 wherein the cavity is shaped so that the ridge is sized to support the shell on a lower surface of the ridge against a cut lip of a second identical shell with the bases of the two shells spaced apart when the shell is nested within the second identical shell.

25. The thermoforming method of claim 24 wherein the cavity is shaped so that the ridge has at least one wall obtusely angled with respect to an adjoining portion of the side wall so that a gap is formed between ridges of the two shells when they are nested.

26. The thermoforming method of claim 22 wherein the cavity is shaped so that the upwardly extending walls include a ridge below the cut lip, the ridge protruding away from the volume and extending around the entire periphery of the upwardly extending walls.

27. A method of vacuum thermoforming a container which includes an outer surface including an outwardly-projecting ridge, the container further including a base, side walls, and an inwardly-projecting cut lip, the method comprising the steps of:

(a) providing a three-part mold defining a cavity conforming in shape to the outer surface of the container, the cavity including an undercut portion corresponding to the ridge of the container, the mold including separable first, second and third portions, the first portion including a planar upper

surface and an upper lip, the first portion defining an upper part of the undercut portion, the second portion defining a lower part of the undercut portion and further defining a surface corresponding to the side walls of the container, the first and second portions of the mold being separable along a part line corresponding to the outermost extent of the ridge of the container, the third portion defining a surface corresponding to the base of the container;

(b) positioning a heated sheet of thermoplastic material over the mold;

(c) drawing the heated sheet of thermoplastic material over the upper lip of the mold and down into the cavity and into the undercut portion of the mold;

(d) cutting the thermoplastic material along the upper lip of the mold to separate the drawn thermoplastic material in the mold cavity from the remainder of the thermoplastic material, the separated, drawn thermoplastic material constituting the thermoformed container;

(e) separating the first and second portions of the mold; and

(f) removing the thermoformed container from the second and third portions of the mold.